Selection of edges for jitter measurements on PRBS9Q pattern

This compares two ways of selecting edges on which to measure jitter (J3u, J_{RMS}) in a PRBS9Q pattern.

This is in support of Yasuo Hidaka's comment and to align with li_3ck_01_0521

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Supporters, changes from version a.

- Phil Sun, Credo

Changes from version a:

- authors; list of supporters
- Comments in *italics* *underlined* (1 line on page 3, one line on page 5)

Background

- The measurements of J3U and J_{RMS} on PRBS13Q edge selection is reasonably easy – pattern segments with isolated edge are available for all 12 edges
- In case of PRBS9Q few edges are well isolated hence the edge selection is less simple
- *Currently this problem is of concern for EOJ; this study was so far inconclusive hence not presented here*
- There are two proposals for edge selection on PRBS9Q; one by Zivny-Hidaka (ZH method), one by Mike Li (L method)
  - The Li method is given in https://www.ieee802.org/3/ck/public/21_05/li_3ck_01_0521.pdf
  - Zivny-Hidaki selection includes additional consideration for dispersion in copper - intended to reduce the sensitivity to noise and/or to slow slope of the edge
  - This work compares the two edge selections

Edges selected in the two methods

- the ZH method:

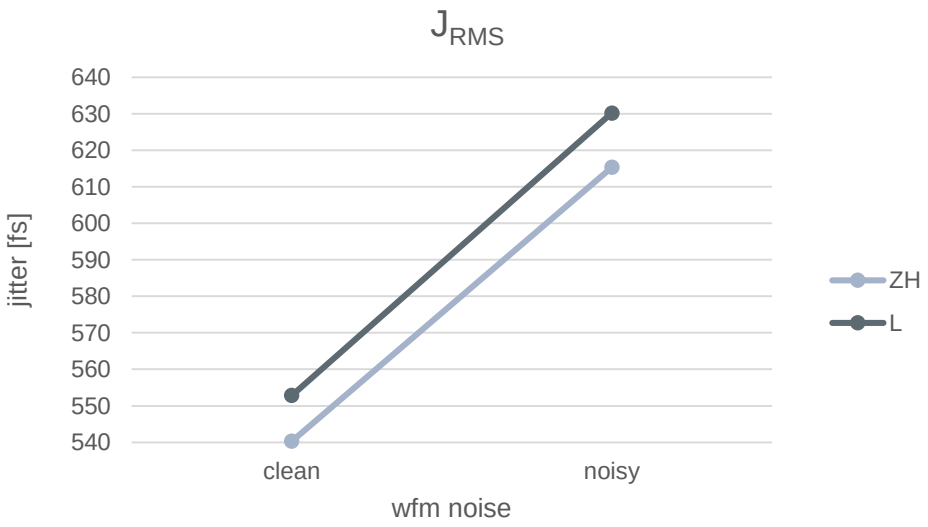
step	range	symbols	index of transition
R01 :	[195:202] :	20001302	198
R02 :	[275:282] :	20002312	278
R03 :	[260:267] :	10003311	263
F10 :	[257:264] :	11110003	260
R12 :	[265:272] :	31112311	268
R13 :	[166:173] :	01113312	169
F20 :	[322:329] :	22220012	325
F21 :	[466:473] :	12221011	469
R23 :	[210:217] :	32223303	213
F30 :	[002:009] :	33330011	005
F31 :	[107:114] :	03331012	110
F32 :	[401:408] :	03332002	404

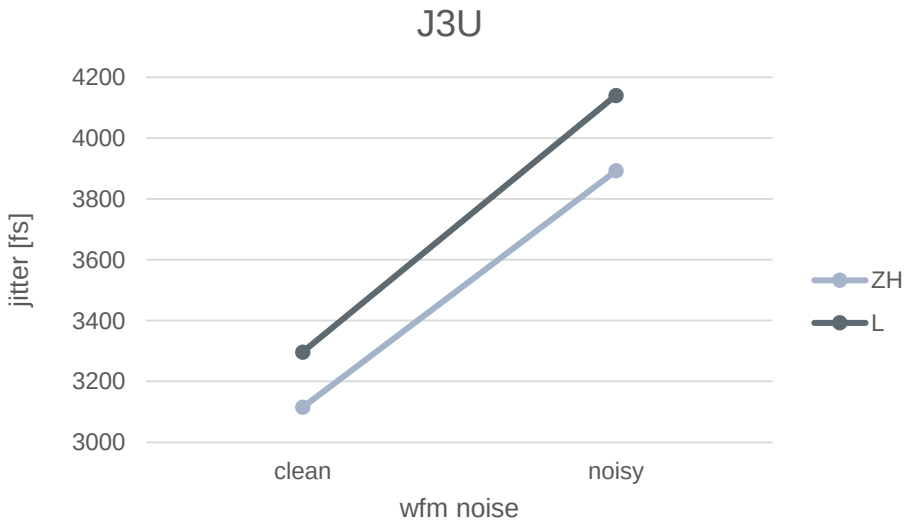
- the L method:

step	range…from	to	symbols	index
R03	260	266	1000331	263
F30	511	8	233333001	5
R12	464	470	3112221	466
F21	254	261	12211110	256
R01	503	508	200113	505
F10	256	264	211110003	260
R23	210	216	3222330	213
F32	507	1	133223	509
R02	63	70	20022223	65
F20	321	328	12222001	325
R13	166	172	111331	169
F31	263	269	331112	265

Compare the two methods on both a clean waveform and a noisy waveform

- ~~Reference: PRBS13Q waveform, 12 edges~~ *not yet accomplished*
- Method ZH and method L on:
- Clean PRBS9Q waveform
- Noisy SNR waveform
  - SNR impaired intentionally by using ½ of digitizing range





Results – two methods compared for J_{RMS} and J3U

- Both methods give a similar result
- The L method rises somewhat faster when the signal's noise increases, i.e. it is more noise sensitive
- We recommend the ZH method

Backup: the rationale for method ZH

Due to the nature of electrical dispersion, for electrical signaling we need not worry much about the symbols after the edge of interest. Here's the compare as an example: when we need a transition from A->B, do we:

consider xxxAABBxxxx, or should we instead

consider xxAAABxxx

in other words, if on electrical signal we only worry about positive dispersion, we don't worry much about the B symbol having a run length > 1.

So this is the rule on selecting xxAAABxxx vs. xxAABBxx .

2nd rule:

in case like the above there are two AAAB sequences within the pattern. Which one to select?

I We select the one where the B symbol is not followed by an inversion of slope (from the AàB slope).

Hence we would not choose

R1: [384:394] 3030001003

Since after the 01 the next immediate transition is 10. So the 1 is a runt.

This second rule is simply to acknowledge that with a bit of ISI the runts might be harder to identify.

Questions?

- Thank you